REMARKS

The applicants appreciate the careful examination the Examiner has given to this application and believe the claims as amended will satisfy the Examiner's concerns.

Regarding Claim Rejection 35 USC §112

Claims 5, 9, 17, 29 and 31 have been amended to provide consistency between claim language and specification, wherein "cascaded leaky bucket mechanism" has been deleted. Accordingly, this rejection is believed to be overcome.

Regarding Claim Rejection 35 USC §102

Claims 1-4, 17-19 and 22 have been rejected under 35 USC §102(e) as being anticipated by Santiago (2002/0186661).

Claims 1 and 17 have been amended to more clearly formulate the invention and to clearly differentiate from the prior art for the reason set out below.

Santiago provides a system for policing individual flows and subflows of a data stream. However, there are substantive differences between Santiago and the present invention, and the innovative concept (of cascaded policers) is not taught by Santiago, nor is it trivially derived from Santiago, or from Santiago in view of other prior art.

In Santiago, the access to temporarily unused capacity of sub flows is achieved by policing the "flow" as a whole, i.e. the sum of the sub flows, and then only police individual sub flows when the overall flow rate exceeds its allocation. There are thus 2 states of traffic policing in Santiago [0097]: *under low traffic conditions*, up to a predetermined threshold bandwidth used by the (overall) flow, sub flows are not policed; *under high traffic conditions* individual sub-flow policing is enabled. Furthermore, each sub flow policer, when active, is independently policing according to its own set of parameters. <u>One</u> sub flow (a single critical sub flow) provides

guaranteed performance, while leaving other sub flows to operate as "best effort" sub flows, see para [0095] of Santiago. The de-facto sharing of the available bandwidth among the sub flows, with the exception of the single critical sub flow) is controlled only by their relative priority.

In contrast, in the present invention there is no specific common flow (or service) policer, rather each sub flow (class in the terminology of the present invention) has its own guaranteed rate policer. Given this, there is only "effective" overall flow policing because the sum of the sub flow policed rates equals the total guaranteed flow rate limit (see, specification page 8, lines 16-20).

Another important distinction is that the policer of each lower priority class is linked to the policer of the immediately higher priority class, by taking into account the actual traffic being policed by the higher priority class. This concept is well described in the specification.

To summarize, according to the novel concept of the present invention, the policing parameters (guaranteed rate and burst tolerance) of each policer are not statically defined, but vary dynamically with the traffic being policed. Specifically, the policing parameters of the second priority policer are composed of a static component (the sum of the guaranteed rates of the first and the second priority policer) and reduced by a dynamic component, namely the dynamically varying conforming traffic rate of the first priority packet stream. Similarly, 3rd, 4th, and generally n-th priority policers have their policing parameters composed of a static component (the sum of 1st to n-th guaranteed rates), reduced by the sum of the conforming traffic rates of the 1st to (n-1)th class. In the described embodiment, this is achieved by cascading the static (guaranteed rates) and the dynamic (conforming actual traffic) components from each priority class to the next lower class.

We can see from the equation implied by the description (page 7, lines 21-24), that, for example, the second policer operates to police traffic of the second priority class to

$$C2 = R2 + (R1 - C1c),$$

where C2 is the (dynamically changing) policing parameter for class 2,
R2 is the static policing parameter for class 2, i.e. a guaranteed rate,
R1 is the static policing parameter for class 1, i.e. also a guaranteed rate, and
C1c is the actual conforming traffic (traffic within the rate limit of C1) of the first priority traffic.

This concept of the present invention is not found in any of the prior art cited. It is the differentiating idea, which provides the present invention cascaded policer with the ability of guaranteeing rates (and burst tolerances) for multiple levels of priority, each with its own guarantee, and allows it to distribute the unused capacity according to priority. At the same time, non-conforming traffic is marked (policed) appropriately if no excess bandwidth is available at any priority level.

The method of the present invention thus provides precise "fair" control over the distribution of excess available bandwidth, at all traffic levels, <u>unlike the Santiago system</u> of policers with its two modes of sub flow control (depending on the overall flow), and its limitation of only one guaranteed rate sub flow under heavy traffic.

Thus, the Applicants believe that claims 1 and 17, as amended, sufficiently differentiate from Santiago for the reasons stated above, and claims 3-4, and 18-19 depend on the respective amended claims 1 and 4. Therefore the rejection 35 USC §102 has been overcome.

<u>Regarding Claim Rejection 35 USC §103</u>

Claims 5-8, 20-21 and 23-35 have been rejected under 35 USC §103(a) over Santiago in view of Elwalid; claim 9 has been rejected over Santiago in view of Elwalid and further in view of Fichou; and claim 5 has been rejected over Fan in view of Elwalid.

The Examiner's rejections are respectfully traversed for the reasons set out below.

A detailed analysis of Santiago reference has been provided above, and a detailed analysis of Elwalid, Fichou and Fan reference is provided below.

Elwalid (5978356)

Elwalid is concerned with shaping of traffic classes according to delay tolerances, in order to reduce the effective bandwidth.

In paragraphs <16>, <32>, and <35> of the examination report, the examiner cites Elwalid column 4, lines 55-65 regarding "cascaded leaky buckets".

The examiner's attention is respectfully drawn to the fact that Elwalid does not discuss "cascaded leaky buckets" in the sense of cascaded policers. The "multiple cascaded leaky buckets" of Elwalid are a known method for controlling or shaping a single traffic stream, where the multiple bucket design is for the purpose of simultaneously matching a complex set of traffic parameters to the single stream, for example, in terms of average and peak bit rates, burst rates and burst durations. The term "cascaded" in Elwalid does not have the same meaning as "cascaded" in the present invention.

The present invention acknowledges leaky buckets in the prior art (please see spec page 2 lines 6-20), including multiple leaky buckets for the purpose of policing average rate and burst tolerance. The innovative aspect of the present invention is not in the use of leaky buckets per se, or "cascaded leaky buckets" in the sense of Elwalid, but in the use of multiple leaky buckets, each dedicated to one of the traffic classes , where the "left over" capacity of a higher priority class is dynamically added to the capacity of the next lower priority class.

Fichou (6072773)

Fichou is concerned with a call admission control (CAC) procedure, for estimating the availability in terms of bandwidth and QoS on connection setup.

In <33> of the examination report, the examiner cites Fichou column 7, lines 46-55 and page 25, line 4 regarding aggregate burst tolerance.

Fichou mentions burst tolerances (BT), including the burst tolerance for the high priority traffic BT(0) and for the whole traffic BT(0+1). The bracketed numbers (0) and (1) refer to traffic marked with CLP (Cell Loss Priority) set to 0 (equivalent to high priority traffic) and 1 respectively. Before dealing with admissibility of

connections (CAC), Fichou enumerates the six standard Traffic Descriptors for ATM traffic (Fichou column 6, line31 to column 7, line 55). This is merely a description of standard parameters for characterizing traffic, and bears no direct relevance to the cascaded policers, including burst tolerance policers of the present invention.

In contrast, in the present invention, individual policers (including burst tolerance policers) are provided for each class, and are cascaded as described in the specification, to provide each lower priority policer dynamically with the unused capacity from the higher priority policer.

Fan (6324165)

Fan is concerned with a switch architecture supporting traffic classes with different QoS requirement by means of dynamic feedback from output stages to input stages, designed so that traffic into the switch fabric (core switch module) is controlled.

In <12> of the examination report, the examiner cites Fan Fig 4 and column 10, lines 41-50 regarding "cascaded policing". In this section, Fan introduces the notion of separate rate controllers such that the sum of the rates of the rate controllers (M) must not exceed the rate provided by the connection (C). However, the present invention does not propose rate controllers (also known as shapers), but policers, the difference being that shapers employ buffer storage and scheduling of traffic, in effect reordering packets, whereas policers merely mark or drop packets.

In <12> of the examination report, the examiner further cites Fan col 3, lines 14-40, col 10, lines 25-63, and col 11, lines 25-59 regarding multiple classes of traffic with different rate guarantees.

The goal of the dynamic rate control (DRC) as stated in Fan (col 3, lines 14-40) is to respect individual rate guarantees while "distributing any unused bandwidth in a fair manner". However the present invention is more precise in what constitutes "fair manner", and furthermore, the present invention does not rate control but polices the traffic.

While there are similarities between policing and shaping, both possibly being based on leaky buckets, they are not the same, and techniques used in shaping are not

always easily applicable to policers and vice versa.

Fan rate controls each class to a single rate R-sub-i independently, where R-sub-i is initially equal to the guaranteed rate M-sub-i. Fan then makes excess bandwidth available to all classes, by using feedback from a bottleneck point in the switch (column 11, formula line 33). By using a predetermined weighting factor w-sub-i, Fan then distributes the estimated excess bandwidth to the individual classes.

In contrast, the present invention polices traffic classes according to the guaranteed rate of each class, while permitting (not marking or policing) traffic of a lower priority class even if it exceeds the guaranteed rate if unused bandwidth is available from a higher priority class. This is done in the described specific manner dynamically using the cascaded policers. Where there are 2 or more classes, excess or unused bandwidth is cumulatively made available from higher to lower priority classes.

Thus, both the method as well as the results obtained are substantially different between the methods of Fan and the present invention.

In <12> of the examination report, the examiner further cites Fan col 13, line 53 to col 14, line 23 regarding rate class guarantees.

The description in Fan col 13, line 53 to col 14, line 23 is concerned with the details of the complex dynamic rate control (DCR) system involving multiple feedback loops in a switch, specifically the calculation of pseudo-rates to which individual classes are scheduled, based on the feedback from bottlenecks in the switch.

In summary, the system of Fan, while employing leaky buckets to control schedulers (to serve packet queues), does not include the elements used to manipulate the cascaded policers of the present invention.

It is clearly not obvious how the simple system of passing excess bandwidth from policer to policer (in the cascaded policer of the present invention) could be derived from the rate control method involving schedulers, leaky buckets, and feedback loops (in the switch of Fan), or derived from Fan in combination with Elwalid.

In <35> of the examination report, the examiner cites several sections of Fan (as in

<12> above), and the same arguments apply.

In <35> of the examination report, the examiner further cites Fan col 11, lines 25-59 regarding the storing of traffic capacities which are not policed in one leaky bucket, into another leaky bucket of a lower capacity. The concept of storing traffic capacities as described in claim 5 of the present invention relies on the common knowledge of persons familiar with leaky bucket design. Nevertheless, Fan does not disclose cascading leaky buckets in any form, and the "cascading leaky buckets" of Elwalid are not comparable to the cascaded policers of the present invention, as noted above.

Therefore, in view of the above arguments, even though if Santiago would have been combined with Elwalid, or Fan would have been combined with Elwalid, or Santiago would have been combined with Elwalid and further combined with Fichou, it would not lead to the present invention.
Thus, the examiner's rejections under 35 USC §103 have been overcome.

An early allowance of this application is courteously requested.

The Commissioner is hereby authorized to deduct any prescribed fees for these amendments from our Company's **Deposit Account No. 501832**.

Yours truly,
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By: ______________________

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